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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/829,176	04/22/2004	Ortmund Lang	54489	6042

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EXAMINER

TUCKER, ZACHARY C

ART UNIT	PAPER NUMBER
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1624

DATE MAILED: 04/13/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/829,176

Applicant(s)

LANG ET AL.

Examiner

Zachary C. Tucker

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-7 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1 and 3-7 is/are rejected.
- 7) ☒ Claim(s) 2 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 22 April 2004 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>22Apr.3Sep04</u> . | 6) <input type="checkbox"/> Other: ____.  |

## **DETAILED ACTION**

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 3, 6 and 7 are rejected under 35 U.S.C.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The ratio specified in claim 3 is not a proper ratio. Only one element of the ratio is specified, the amount of runback at the upper end of the dividing wall, into the inflow and offtake sections of the column, but what this amount of runback is relative to is not specified. Additionally, the ratio is not proper, because no units are specified. In order for one of ordinary skill to understand the scope of protection afforded claim 3, should it be allowed to issue, the ratio must be complete, that is, both elements of the ratio be particularly pointed out, and the units of the quantities comprising the ration must be specified.

A "theoretical plate" in a distillation column is just that, theoretical. It is not a real number, as would be the case for a distillation column with real, physical plates as structured packing material. Instead, a theoretical plate number is a mathematical construct which expresses the number of plates which would be necessary in a distillation column of the same size to perform with the same degree of separation efficiency. The number of theoretical plates possessed by a given distillation column depends on the operating temperature, the pressure and, in the case of a dividing wall column, the amount of heat transfer across the dividing wall and the number of dividing walls. None of these parameters are set forth in the claim, so the number of theoretical

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plates, and therefore, the theoretical spacing between these theoretical plates, depends on undefined variables. Where along the distillation column constitutes being between the 5<sup>th</sup> and 30 or 2<sup>nd</sup> and 20<sup>th</sup> theoretical plates, as specified in claim 6, depends on particular values not specified in the claims, so the location on the column specified in claims 6 and 7 is not a definite location.

***Claim Rejection – 35 USC § 103***

The following is a quotation of 35 U.S.C.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 4 and 5 are rejected under 35 U.S.C.S.C. 103(a) as being unpatentable over US 3,297,701 (Brader and Rowton) in view of Schultz et al, *CEP Magazine 'Online!'* vol. 98(5), pages 64-71(2002), Lestak and Collins, *Chemical Engineering*, vol. 7, pages 72-76 (July 1997) and Kaibel, G. *Chemical Engineering and Technology*, vol. 10, pages 92-98 (1987); all of which were cited by applicants in the Information Disclosure Statement filed 3 September 2004.

At the time the invention was made, the process of claims 1, 4 and 5 would have been obvious to a process engineer of ordinary skill, given the teachings of the Brader and Rowton patent, in view of the three articles authored by Shultz et al, Lestak and Collins and Kaibel.

Purification of triethylaminediamine (TEDA) by distillation is well-known and is old. Instant claim 1 assumes that distillation of TEDA is known, by the manner in which said claim specifies no particular steps for the distillation nor any apparatus therefor

necessary. Indeed, the instant specification teaches purification of TEDA by distillation is known at page 1, lines 27-38.

Dividing wall-type distillation columns are also known and are not novel. Page 2, lines 8-15 of the instant specification says as much. Dividing wall columns, according to Schultz et al, Lestak and Collins and Kaibel, have been for a long time applied to the purification of various petrochemicals. No process of purifying *TEDA* by distillation in a dividing wall-type distillation column is disclosed in the prior art, however. So, with respect to the process according to instant claims 1, 4 and 5, the question as to the patentability of the process there described will lie in whether or not application of a dividing wall-type distillation column in a process of purifying TEDA by distillation is obvious.

At the time the invention was made, it would have been obvious to a skilled chemical engineer to purify TEDA by a process wherein a dividing wall distillation column is employed. US 3,297,701 (Brader and Rowton) discloses a process for making, and then purifying TEDA. The starting material (Example I) is N-aminoethylpiperazine, reacted over an 86%-silica and 12%-alumina catalyst. Triethylenediamine forms by cyclization of the aminoethylpiperazine. The product stream, which contains the starting material, TEDA and piperazine, principally, is purified by distillation, after being cooled by a dry ice-acetone mixture inside a condenser.

The references cited above which are authored by Schultz et al, Lestak and Collins and Kaibel, all speak generally to the advantageousness of dividing wall distillation columns insofar as their application to multi-component stream separations. Schultz et al teaches, most notably, teaches that a dividing wall column (DWC) can

replace an existing two-column sequence (page 64, column two, second to last paragraph), and on page 71, in column 1, second to last paragraph, the statement:

**Chemical engineers should look for unconventional applications of DWC technology. Simply because a fractionation system does not meet the single-feed, three-key-component, three-product criteria, does not mean that DWC technology cannot be adapted to the separation. The UOP application for the PEP DWC is an example of this.**

which provides ample motivation for any skilled engineer to apply DWC technology to ANY type of separation where it has heretofore not been applied.

Lestak and Collins teaches, most notably, that “Generally, the technology (DWC distillation) should be considered in any ternary (three-component) separation, as a possible low-cost alternative to conventional schemes. DWC distillation is vastly more energy-efficient than a distillation with sequentially oriented binary separation columns, because only one condenser and one reboiler is employed. This is the gist of the Lestak and Collins article, that large energy savings are achievable with DWC technology.

Kaibel teaches also that DWC have low energy demand compared with the equivalent configuration of sequential binary columns (page 96, last paragraph). The DWC is, according to Kaibel a consistent apparatus simplification of the thermally-coupled distillation column sequence (as shown in figure 11 on page 97 of Kaibel). The skilled chemical engineer understands DWC to be the ends to a logical progression of simplification of purification schema – Kaibel teaches this graphically on page 93, in Figures 1, 2 and 3. Figure 4, on page 94, shows the DWC diagrammatically. When viewed in this manner, a DWC column can be appreciated as a simplification of the

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“nested,” thermally coupled cascade of distillation columns, like as is shown in figure 3 of Kaibel.

Teachings as from the Schultz et al, Lestak and Collins and Kaibel are not lost on the chemical engineer of ordinary skill. Such a person, familiar with conventional means of purifying TEDA, would, upon review of Schultz et al, Lestak and Collins and Kaibel, at once envision the application of DWC technology to the distillation of TEDA. To suggest otherwise flies in the face of reason, given the general teachings and general suggestion found in the references to apply that technology to practically any multi-component separation. There would be a high expectation of success, as there is no teaching as to the type of material purified by DWC being limited to any particular class of substances.

Limitations posed by instant claims 4 and 5 are not seen as providing for a patentable distinction over the combination of Brader and Rowton in view of Schultz et al, Lestak and Collins and Kaibel. The residence time in the bottom of the distillation column of the Brader and Rowton patent is between 1 and 15 minutes; the pressure range of 0.5 to 5 bar includes atmospheric, or standard, pressure.

Clearly, a process whereby TEDA is purified by distillation in a dividing wall column is in the teaching of Brader and Rowton in view of Schultz et al, Lestak and Collins and Kaibel.

***Drawing  
~and~  
Specification***

The single figure is objected to under 37 C.F.R. 1.84(t) and 1.84(u), because the drawing sheet is not numbered, starting with one, as required, and the drawing is not numbered, starting with figure 1, as required.

The specification is objected to under 37 C.F.R. 1.74, because no section headed "Brief Description of the Drawings" is present therein. It is suggested that applicants amend the specification so that such a section is introduced.

***Allowable Subject Matter***  
***~and~***  
***Relevant Prior Art***

Claim 2 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The specific type of dividing wall column called for by instant claim 2, wherein the dividing wall extends all the way down to the bottom of the column so as to form separate chambers in the lower region of said column, is not suggested in the prior art relied upon in the rejections set forth under 35 U.S.C. 103(a) hereinabove.

DWC distillation, in the preparation of caprolactam, a nitrogen-containing heterocyclic compound, like TEDA, is known from the prior art. US 6,147,208 (Achhammer et al) discloses a process for making caprolactam and hexamethylenediamine, wherein dividing wall columns are employed in various separations of the intermediates (see col. 2, lines 59-62; col. 3, lines 8-10; col. 8, lines 30-31; col. 8, lines 47-48; col. 12, lines 34-35, col. 12, lines 49-50).

***Information Disclosure Statement***

Several items cited in the Information Disclosure Statements filed 22 April and 3 September of 2004 are not in the English language, and thus cannot be read and understood by the examiner to any extent. The last four items cited on the PTO 1449 form accompanying the 3 September 2004 statement and the last three items cited on the PTO 1449 form accompanying the 22 April 2004 statement have thus been "lined



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through" by the examiner, as he cannot understand German. Applicants are invited to provide English translations of these references so that they can be considered by the examiner and fully evaluated for what they disclose.

***Conclusion***

Any inquiry concerning this communication should be directed to Zachary Tucker whose telephone number is (571) 272-0677. The examiner can normally be reached Tuesday-Thursday from 8:00am to 4:30pm or Monday from 6:00am to 1:30pm. If Attempts to reach the examiner are unsuccessful, contact the examiner's supervisor, James O. Wilson, at (571) 272-0661.

The fax number for the organization where this application or proceeding is assigned is (571) 273-8300.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (571) 272-1600.

zt

A handwritten signature in black ink, appearing to be "Zachary Tucker", written over a horizontal line.